Chapter 6

Service Level Objectives

Introduction

As stated previously the key terms in understanding standards of response coverage are: *distribution, concentration, overall resource efficiency, response reliability and response effectiveness.* They are quantifiable performance measures that can be used by the fire department to objectively and quantitatively analyze the relationship between existing or new fire station locations and the department's capability.

The location of fire stations impacts only one segment of the continuum, travel time from the fire station. *Travel time* and *response time* are not the same thing. When we say that a particular station has a four-minute *travel time* to an address, it doesn't mean that a unit will arrive there in four minutes from the caller's viewpoint. Nor will the unit always respond from a fire station

Now that minimum staffing and equipment needs have been established for each level of risk, LF&EMS has determined how fast the entire force of staffing and equipment must reach the fire scene to be effective. Data from literature regarding fire growth and the department's own historical incidents have been used to determine the maximum travel time that would allow the staffing and equipment to get to a fire scene while a fire was still in its early stages of growth and to get to a medical scene before significant deterioration of the patient's condition occurs.

Distribution of Resources

The term "distribution" describes the resource locations needed to minimize and terminate emergencies by assuring a sufficiently rapid first due response deployment. Distribution is measured by the percentage of the jurisdiction covered by first-due, or primary, response companies within the adopted public policy response time goals for each risk type and outcome measure.

The measure of distribution is based on risk. Therefore it is possible for some low-risk response zones to have adequate distribution of coverage because they can handle longer travel times, while high-risk zones have shorter travel times and

might not get a first-due company on scene quickly enough to meet identified goals for that risk.

This view of Lynchburg's response system looks at fire & EMS resource deployment in terms of a static placement of resources and their theoretical response potential. By taking this theoretical view of the system it is possible to determine whether or not response standards can be met from existing infrastructure and with current staffing levels, when all companies and units are in quarters and available for emergency response.

Station Locations

LF&EMS uses a variety of factors to determine optimal site locations for its fire stations. These factors include pertinent national standards, including NFPA, the Insurance Services Office (ISO), and the American Heart Association with regard to cardiac arrest, covering both response time (how fast) and deployment standards (how many and what type of resources on scene).

Lynchburg's current fire station positioning does not provide a completely efficient distribution of the available emergency response resources. Two current fire stations are located within close proximity of one another and other surrounding stations. Fire Station 2, located at 2006 Grace Street, was built in1958 and is located only about one and one-half miles from Fire Station 1 on Clay Street. The Clay Street Fire Station was built in 1980 and the primary reason that it was constructed at the current location was because the City already owned the property. Fire Station 6, located at 2084 Fort Avenue (Miller Park) was built in 1912 and is only about two miles from Fire Station 2 (Grace Street) and three miles from Fire Station 1 (801 Clay Street). When looking at the four-minute response zones for each of these three stations there is significant overlap. However, when considering the locations of current stations one, two, and six the most consideration was given to the fact that nearly all of the structure fires that occurred were within close proximity to these station locations, providing more than adequate concentration of resources.

Fire Station 7 (Lakeside Drive) and Fire Station 8 (Old Graves Mill Road) were constructed following the 1975-76 annexation of those areas of the City. In an effort to provide better fire protection to the annexed areas, these two stations were built and opened within days of one another. The reason for the site

selection was based on providing adequate distribution of resources in the annexed areas and the ability to access major thoroughfares.

In developing most of this infrastructure, the goal was to balance the elements that comprise a favorable fire station site configuration and three additional areas of consideration when selecting station locations. These areas of consideration are:

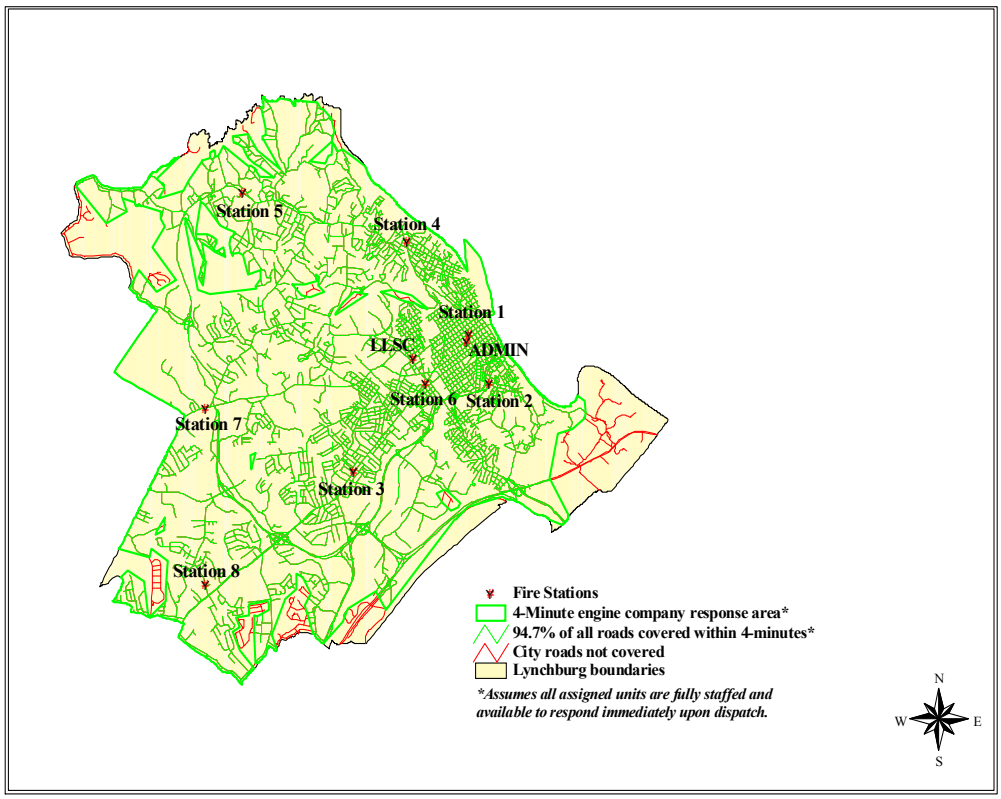
- Placement - Geographic spacing between fire stations that considers natural and human made obstacles or barriers, and provides for coverage efficiency balanced with depth of coverage through limited response zone overlap.
- Response Routes - Proximity and access to multi-directional transportation corridors, sized appropriately for fire apparatus and referred to as run streets.
- Property Acquisition - Availability, lot size, and the cost of suitable sites within the parameters of factors #1 and #2 above.

As noted above, when Fire Station 1 was constructed in 1980 consideration of property acquisition and response route factors was accomplished, but the placement factor with regards to limiting response zone overlap was not adequately addressed.

As noted in Chapter 3, *Standards, Goals and Objectives,* the department currently operates out of eight (8) fire stations divided into two geographically defined districts: Battalion One and Battalion Two. Maximum and minimum staffing capabilities are also discussed in Chapter 3 with the minimum relating to the minimum acceptable number of personnel assigned to each company or unit per shift.

In consideration of the planned replacement/relocation of Fire Stations 2 and Fire Station 6 the department should engage in a formal study of fire station locations, using geo-spacial technology, transport route analysis and property acquisition considerations.

Map 6.1 **Four-Minute Engine Company Response Area**[1]

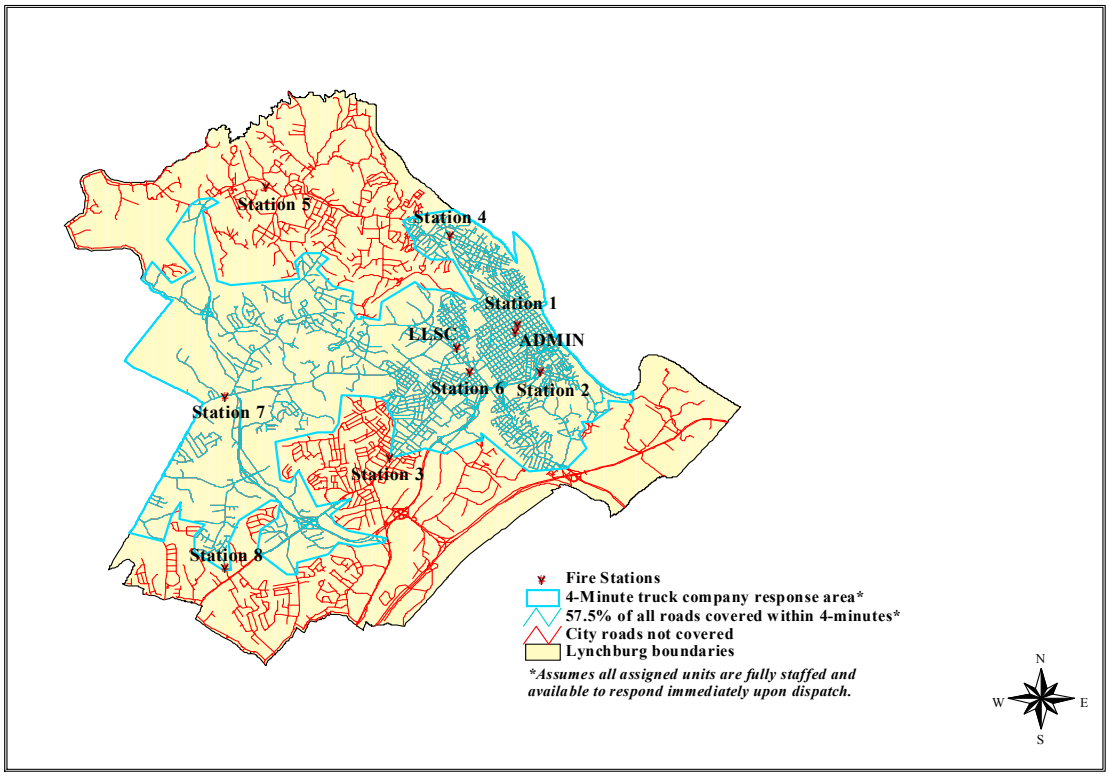


The above map shows that 94.7 percent of all roads within the response area are predicted to be reached by at least one engine company from current stations within a four (4) minute travel time. The roadways indicated above in red are roadways that are not reached within the four (4) minute travel time objective for the first due company.[2]

The areas that are beyond the four (4)-minute engine company travel time objective include portions of Wiggington Road (including the Boxwood subdivision), Hawkins Mill Road, Enterprise Drive (including most of Wyndhurst), the area behind Target in the Wards Crossing Shopping Center (including Chesterfield Drive, Windsor Terrace, Melinda Drive, and Alta Lane), and the Tyreeanna area, from Rockwell Road and points east.

[1] *Lynchburg Fire Department: Geographic Information System (GIS) Fire Suppression and Emergency Medical Service Response Capabilities Analysis,* International Association of Fire Fighters, November 16, 2004.
[2] Ibid.

Map 6.2 **Four-Minute Truck Company Response Area**[3]

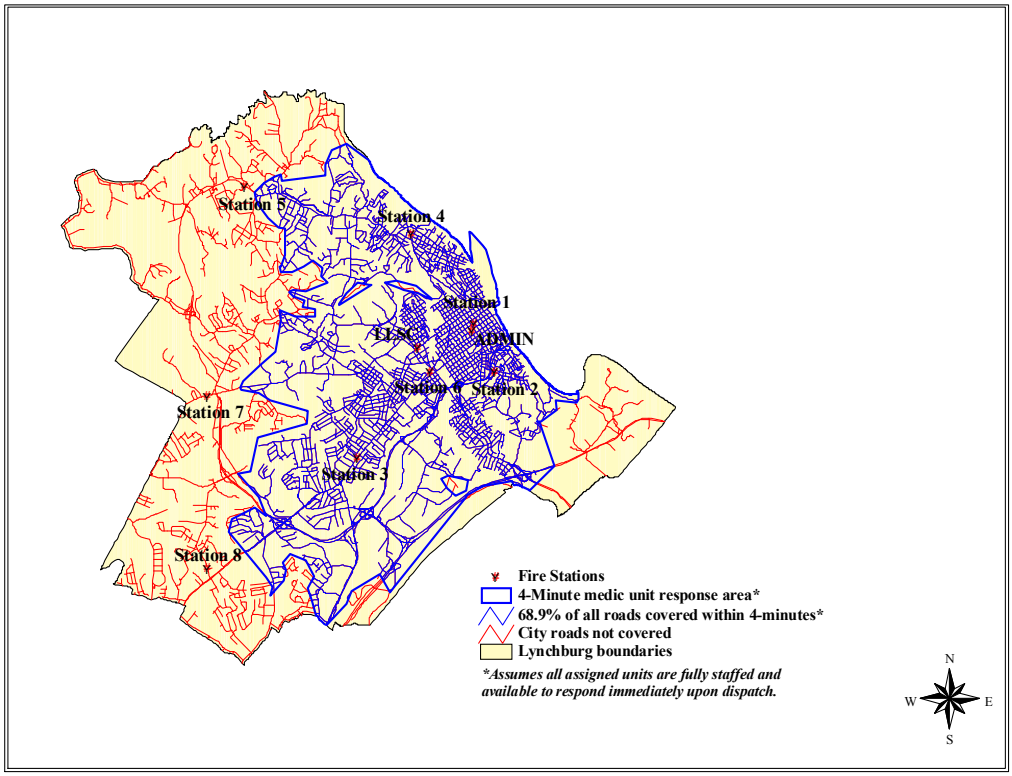


The above map illustrates that 57.5 percent of all roads are predicted to be reached by a truck company within a four (4)-minute travel time. Truck companies perform an invaluable service on the fireground and are assigned to forcible entry, ventilation, search and rescue, utility control, overhaul and salvage work. The response time measure for the truck company is actually to arrive as part of the full alarm assignment within eight (8)-minute travel time. As indicated in the map below, 99.8 percent of all roads are predicted to be reached by a truck company within eight (8) minutes. [4]

[3] Ibid.
[4] Ibid.

The map below shows those roads which are predicted to be covered by an advanced life support (ALS) medic unit within four (4) minutes. A medic unit may access 68.9 percent of roads within four (4) minutes. [5]

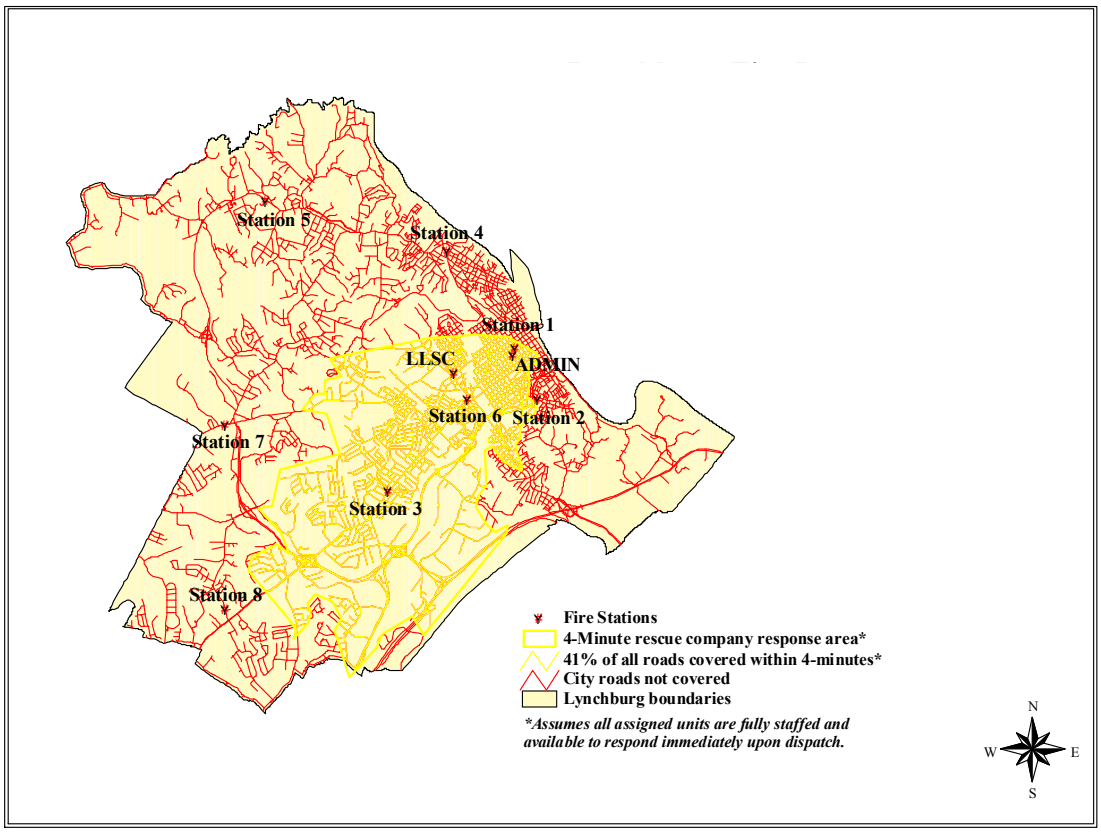
Map 6.3 **Four-Minute ALS Medic Unit Response Area**[6]



While more than 30 percent of the response area is outside of the four (4)-minute travel time objective for the medic units, EMS resources (often ALS) often arrive via an engine company within the four (4)-minute travel time objective.

[5] Ibid.
[6] Ibid.

Map 6.4 **Four-Minute Rescue Company Response Area**[7]



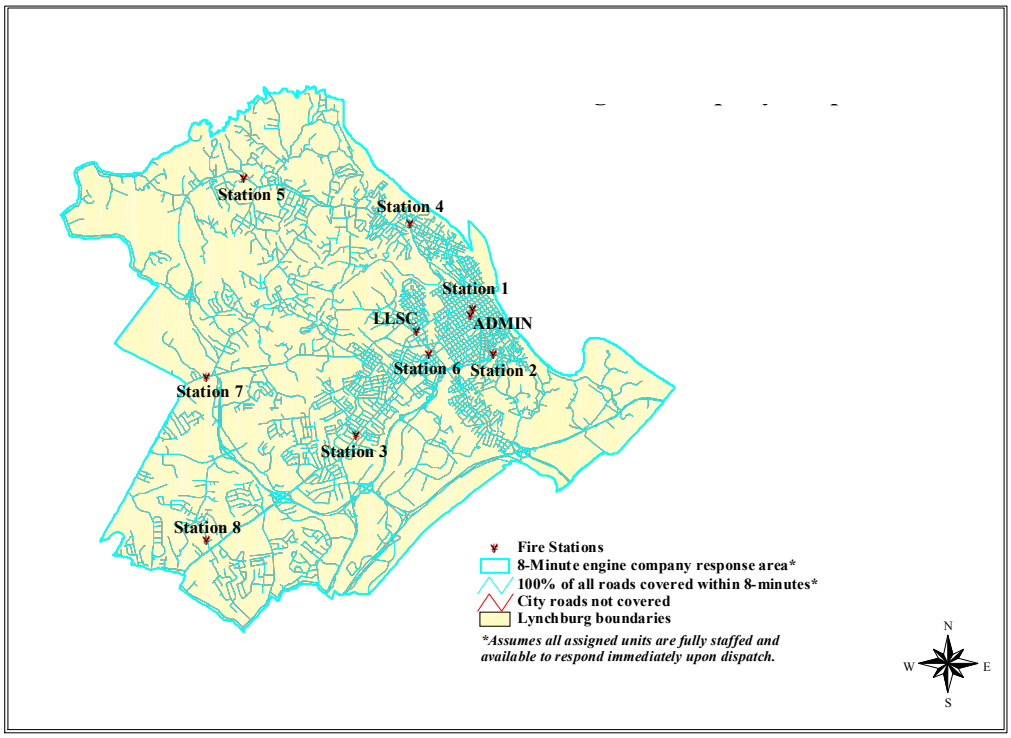
The above map illustrates that only 41 percent of all roads are predicted to be reached by a rescue company within a four (4)-minute travel time. The rescue company operates out of Fire Station 3 (Fort Avenue).

[7] Ibid.

Concentration of Resources

Concentration is the ability to allocate enough resources on any specific risk to keep the event from becoming a major emergency. It refers to the spacing of multiple resources within close enough proximity to allow an initial effective response force to be assembled on scene within prescribed timeframes. An initial effective response force is one that has been deemed capable of stopping the escalation of a fire emergency, stabilizing a medical scene, affecting a rescue, and successfully handling an incident.

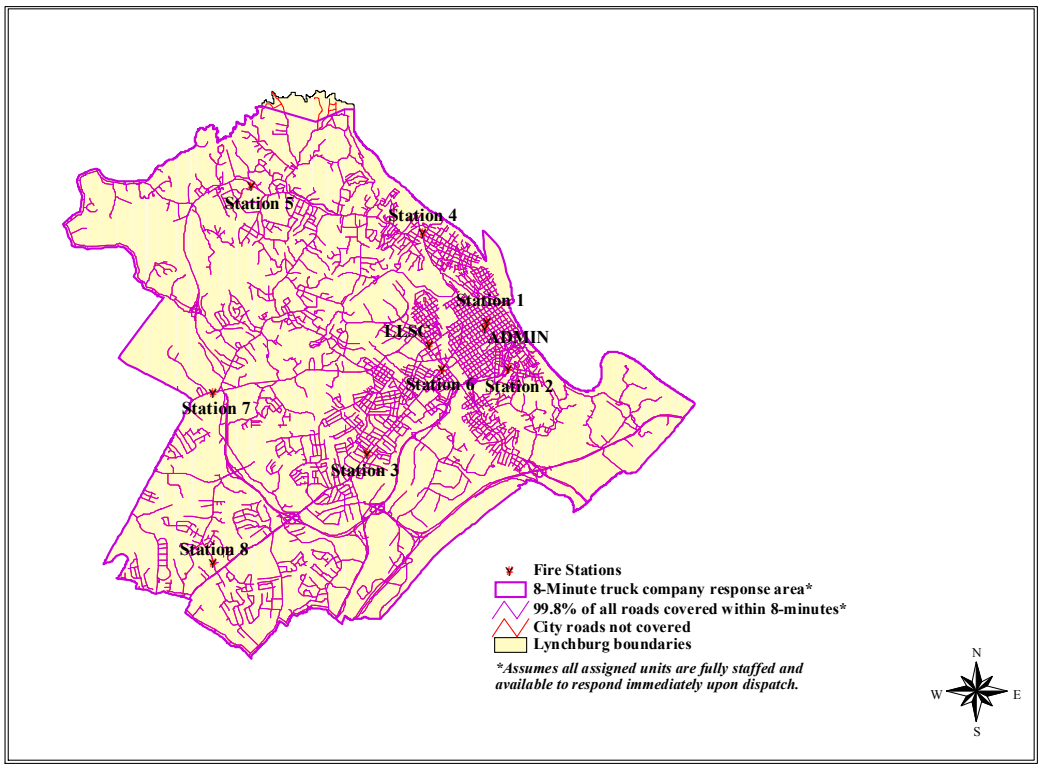
Figure 6.5 **Eight-Minute Engine Company Response Area**[8]



The above map shows those areas that are predicted to be covered within eight (8) minutes travel time from all fire stations. Apparatus may reach 100 percent of roads within the eight (8)-minute travel time objective. Structure fires occurring at the farthest reaches of the eight (8)-minute polygons indicated in the above map are likely to burn up to and beyond the point of flashover, which does present significant risks to fire fighters operating within the structure. This is especially true in structures which have no automatic suppression or detection systems in place. [9]

[8] Ibid.
[9] Ibid.

Figure 6.6 **Eight-Minute Truck Company Response Area**[10]

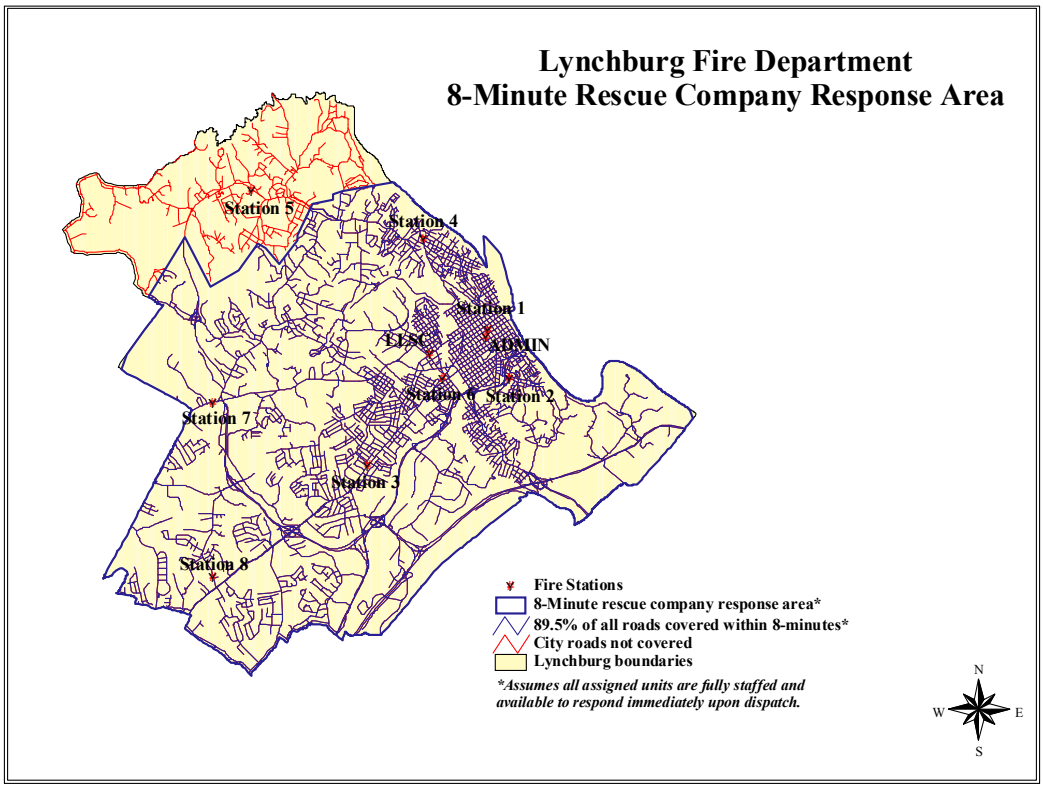


The map above indicates the predicted eight (8)-minute response capabilities of the Rescue Company responding from Station 3 (Fort Avenue). Currently, the unit is capable of assembling on 89.5 percent of all city roads within eight (8) minutes, assuming all units are available to respond immediately upon dispatch. [11]

The areas outside of the eight (8)-minute truck company response area includes John Scott Drive and parts of Old Trents Ferry Road.

[10] Ibid.
[11] Ibid.

Map 6.7 **Eight-Minute Rescue Company Response Area**[12]

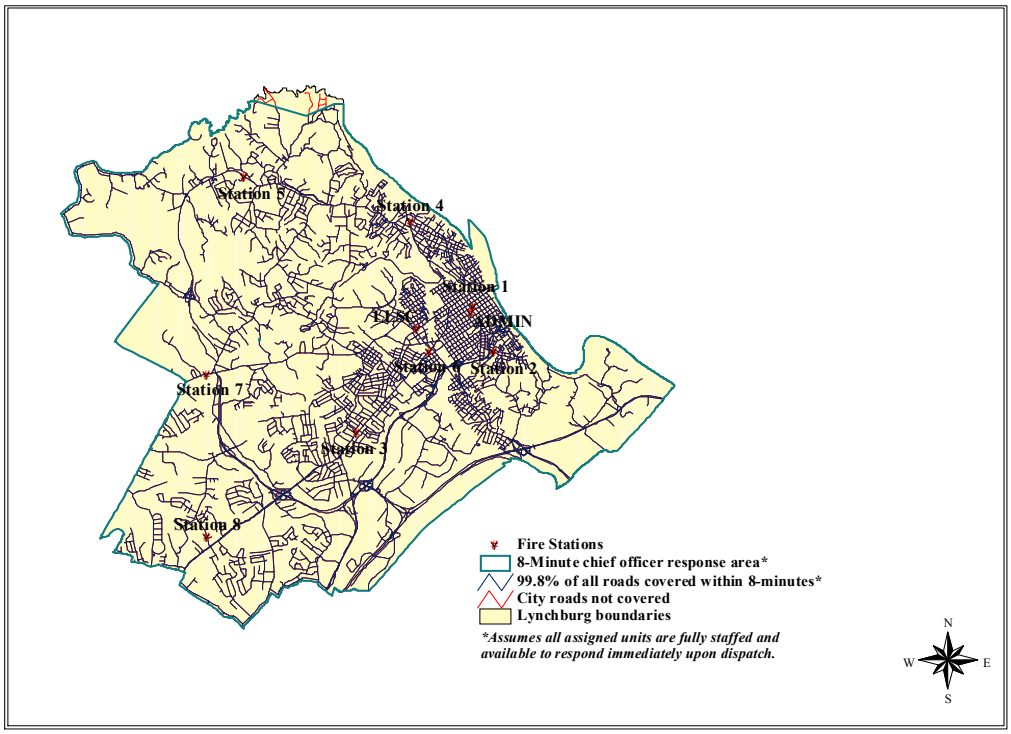


The above map illustrates that the rescue company is predicted to reach 89.5 percent of all roads in the City within the eight (8)-minute response time objective.

[12] Ibid.

The map below indicates that 99.8 percent of all roads are predicted to be reached by the Battalion Chief within eight (8) minutes. [13]

Map 6.8 **Eight-Minute Chief Officer Response Area**[14]

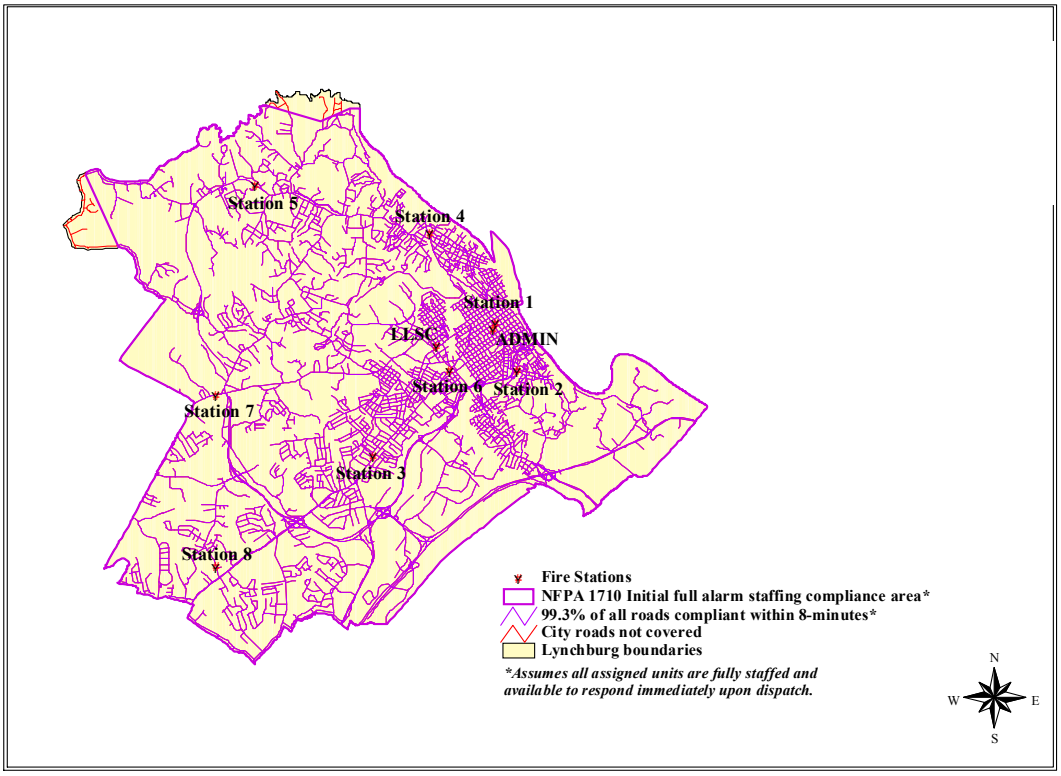


The areas that are outside of the eight (8)-minute travel time objective by the Battalion Chiefs include John Scott Drive and parts of Old Trents Ferry Road.

[13] Ibid.
[14] Ibid.

According to the dispatch procedures for a full alarm assignment for a moderate risk fire, three engines, one truck, one rescue, one medic unit and one battalion chief are dispatched. The map below illustrates that LF&EMS is predicted to be able to respond to 90 percent of all city roads within eight (8) minutes with a full alarm assignment if all units are available. The roads indicated in red on the map below are those roads that are not predicted to be able to receive the full alarm assignment within eight (8) minutes. [15]

Map 6.9 **Initial Full Alarm Assignment Staffing Compliance Area**[16]



The areas that are outside of the eight (8)-minute travel time objective include John Scott Drive and parts of Old Trents Ferry Road, and a portion of Hawkins Mill, Wiggington and Coffee Roads.

[15] Ibid.
[16] Ibid.